when so many determiners affect the same character, the F_2 ratios are only suggestive and not decisive. Until a third and perhaps still later generations have been grown, the assumptions made by the author remain hypothetical, but with the weight of the observed F_2 ratios in their favor. In the Brassicas studied, the situation appears to be much simpler. In the turnip-rooted cabbages or Swedes (*B. Napus*) the roots are always approximately globular, but in the turnips (*B. Rapa*) both globular and elongated forms occur and there appear to be, just as in beets, two elongation genes (L_1 and L_2). Here again the evidence for these two genes is the appearance of the long and round forms in the F_2 in the ratio 15:1, and a later generation must decide the correctness of the interpretation.

In regard to the color of the roots the situation is also quite complex, perhaps even more so than in respect to form. Red is in some cases dominant to its absence, in other cases recessive (owing probably to the presence of an inhibitor), and it may appear in crosses between two whites, white and yellow, rose and yellow, etc., showing its compound nature. Some of the color-ratios are approximately 15:1 and others 3:1, which are also interpreted as indicating the existence of more than one gene capable of producing independently the same color-character. In turnips the upper portion of the roots is red, green, or yellow, each of these colors being epistatic to those following. The lower portion of the roots is white or yellow, having the same color as the flesh, the white being epistatic to yellow. In the turnip-rooted cabbages the heads are either violet-red or green. There are two independent genes which produce violet-red pigmentation, the one giving a light red, the other a dark red. As the latter is completely epistatic over the lighter color, a cross in which both of these genes and their absence are involved, produces an F_2 progeny consisting of dark red, light red, and white, in the ratio 12:3:1. Both in form and color the heterozygotes are often intermediate, so that a more or less completely continuous series of forms is produced, thus making the analysis difficult. This fact makes very important the promised continuation of the work.—GEO. H. SHULL.

Inheritance in wheat.—NILSSON-EHLE[14] gives a further report on his long-continued experiments in the crossing of wheat varieties, dealing this time especially with the density of the spikes and resistance to yellow rust (*Puccinia glumarum*). Both of these characters are lacking in the definiteness which has made the study of many alternative characters easy and the results clear-cut and decisive, but the author's earlier demonstration of several independent genes producing the same apparent character in seed-color of wheat and in the awns of oats has given a key to these more difficult cases. The density of the spikes is apparently modified by three distinct genes, two of which (L_1 and L_2)

[14] NILSSON-EHLE, H., Kreuzungsuntersuchungen an Hafer und Weizen. II. Lunds Universitets Årsskrift. **7**:no. 6. pp. 84. 1911.

promote elongation of the heads, while the third (*C*) acts as an inhibitor which checks the longitudinal development of the heads. When all of these factors are absent, a moderately dense head results, as exemplified by the "squarehead" varieties. When *C* is present and both L_1 and L_2 are absent, the extremely dense "compactum" form is produced. Although considerable transgressive fluctuation renders the analysis doubtful in individual cases, the total result is sufficiently decisive to leave little doubt of the essential correctness of the interpretations. The discovery that several genes may affect quantitatively the same external characteristic has given an explanation of some hybrid progenies which have seemed to breed true to characters intermediate between the parents, and it also explains the intensification of parental characters in F_2 individuals which have often been observed. As an example of the latter phenomenon, a cross between two wheats of intermediate density, having the formulae CL_1L_2 and cl_1l_2, produces some F_2 plants with very dense heads (Cl_1l_2), and some with very lax ones (cL_1L_2). In respect to rust-resistance, the difficulties of analysis are still greater and the author makes no attempt to identify particular genes, but the results of a large number of tests in second and third generations show very clearly two important facts, namely, that there is a segregation of different grades of resistance in the F_2, and that the matter is not generally as simple as BIFFEN found it to be in his crosses dealing with this problem. In none of NILSSON-EHLE'S crosses was there an indication of a simple monohybrid ratio (**3:1**) for rust-resistance, as was found by BIFFEN.

KAJANUS[15] reports an instance in which the *spelta*-character (zigzag rachis and adherent glumes) is recessive to the *vulgare*-character (straight rachis and free glumes), a situation exactly the reverse of that found by von TSCHERMAK. This indicates that there are two genotypes of one or the other of these two phenotypes, thus paralleling the now frequently demonstrated existence of dominant and recessive whites. KAJANUS found presence of awns recessive to their absence, and hairiness of the glumes dominant to its absence, as in all other reported crosses in which these characters have been involved. —GEO. H. SHULL.

Cytology and sexuality of Olpidiopsis.—Overcoming considerable difficulties in the matter of obtaining and managing material, BARRETT[16] has greatly increased our knowledge of the cytology and especially of the sexuality of the submerse chytrids. Three species of *Olpidiopsis*, parasitic on *Saprolegnia* and *Aphanomyces*, were studied, two of which (*O. vexans* and *O. luxurians*) are described as new. The first part of the paper consists of biological observations, among which will be found many valuable suggestions to anyone undertaking similar work. The zoospores are shown to have two equal flagella

[15] KAJANUS, B., Zur Genetik des Weizens. Botaniska Notiser 1911:293–296.

[16] BARRETT, J. T., Development and sexuality of some species of *Olpidiopsis* (Cornu) Fischer. Ann. Botany **26:**209–238. *pls. 23–26.* 1912.